MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for January, 1904, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 167; West Indian Service, cable and mail, 4; River and Flood Service, regular 43, special river and rainfall, 190, special rainfall only, 56; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3025; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. R. C. Lydecker, Territorial Meteorologist, Honolulu, Hawaii; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander H. M. Hodges, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. José Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard meridian is that of San José, $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During the first half of the month the barometer was low over the British Isles, and on the 10th and 15th it fell below 29.00 inches over the north of Scotland. Following this period of low pressure the barometer was abnormally high over the eastern Atlantic from the 17th to the 24th. On the 26th a disturbance approached the British Isles, and by the 28th the barometer had fallen to 28.88 inches at Stornoway, Scotland. During the next twenty-four hours the center of disturbance apparently moved eastward toward the Scandinavian coast. During the 30th and 31st a storm of marked strength crossed the north part of the British Isles. In the vicinity of the Azores the barometer was comparatively low on the 1st and 2d, and 13th to 15th, and continued generally high from the 4th to 12th, and 16th to 31st. Over the western Atlantic the weather was seasonably severe, and the barometric depressions that left the American coast appeared to pass over the ocean in high latitudes. Three of these depressions may be identified with those that reached the British Isles.

In the United States the month opened with a depression of slight intensity over the southeastern slope of the Rocky Mountains. Increasing rapidly in strength, this depression crossed the Ohio Valley during the 2d, attended by heavy snow in the northeastern districts, and passed off the middle Atlantic coast by the morning of the 3d, with gales on the lower Lakes and along the middle Atlantic and New England coasts. This storm apparently passed north of the British Isles during the 7th and 8th. On the morning of the 2d storm warnings were ordered on the Atlantic coast from Savannah to Eastport, and the following special warning was sent to points in New York and New England:

> Snow will be heavy in the interior of New York and New England this afternoon and to-night, with high northeast shifting to northerly winds.

Following the passage of this storm a cold wave swept the districts east of the Rocky Mountains. The Savannah News, of January 7, comments as follows regarding the cold wave in that section:

> When the first intimation of the cold wave's approach was received at the Weather Bureau, word was at once sent to florists and they were warned to have their fires up. These were immediately started, and when the wave reached here flowers were well protected.

From the 19th to the 22d the center of the barometric disturbance moved from the middle Plateau region over the Mississippi Valley and the southern Lake region, with a marked increase in strength during the night of the 21st and the morning of the 22d. At 1 a. m. of the 22d, when the storm center was passing over the lower Ohio Valley, a tornado occurred at Moundville, Ala., killing, according to report, 37, and injuring about 100 persons.

During the 23d and 24th an area of low barometer moved southeastward along the eastern Rocky Mountain slope, followed by a cold wave that carried the temperature to 34° and

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	*31, p.m.	54	108	6, p.m.	38	79	2,900	6.0	483	20.1
II	7, p.m.	28	97	10, a.m.	27	80	1,100	2.5	440	18.3
III	9, p.m.	48	86	12, a.m.	49	64	1,050	2.5	420	17.5
IV	11, p.m.	40	123	13, p.m.	37	108	900	2.0	450	18.8
V	13, p.m.	33	97	15, p.m.	33	81	1,350	2.0	675	28.1
VI	{14, p.m. / 15, a.m.	41 / 54	124 / 114	20, p.m.	32	80	{ 4,550 / 3,400	6.0 / 5.5	758 / 618	31.6 / 25.8
VII	18, p.m.	54	114	23, a.m.	47	53	3,225	4.5	717	29.9
VIII	22, a.m.	53	114	29, a.m.	45	60	3,800	7.0	543	22.6
IX	22, p.m.	32	95	26, p.m.	46	60	2,600	4.0	650	27.1
X	27, a.m.	52	110	30, p.m.	37	75	3,325	3.5	950	39.6
Sums							28,200	45.5	6,704	279.4
Mean of 11 paths							2,564		610	25.4
Mean of 45.5 days									620	25.8
Low areas.										
I	*30, p.m.	50	110	3, p.m.	46	60	3,700	4.0	925	38.5
II	{ 6, a.m. / 6, p.m.	54 / 28	114 / 96	10, p.m.	48	58	{ 3,000 / 2,800	4.5 / 4.0	667 / 700	27.8 / 29.2
III	8, p.m.	51	116	11, p.m.	35	75	2,675	3.0	892	37.2
IV	{10, a.m. / 11, a.m.	50 / 37	119 / 103	15, a.m.	49	63	{ 3,400 / 2,825	5.0 / 4.0	680 / 706	28.3 / 29.4
V	13, p.m.	53	120	17, p.m.	47	58	3,025	4.0	756	31.5
VI	15, a.m.	35	104	16, a.m.	33	91	800	1.0	800	33.3
VII	17, a.m.	48	125	19, p.m.	50	85	2,250	2.5	900	37.5
VIII	20, a.m.	35	112	22, p.m.	47	79	2,725	2.5	1,090	45.4
IX	23, p.m.	49	122	27, p.m.	47	57	4,275	4.0	1,069	44.5
X	29, a.m.	54	109	{31, a.m. / †2, a.m.	31 / 48	92 / 63	{ 2,800 / 2,625	2.0 / 4.0	1,400 / 656	58.3 / 27.3
Sums							36,900	44.5	11,241	468.2
Mean of 13 paths							2,839		865	36.0
Mean of 44.5 days									829	34.5

* December. † February.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*George E. Hunt, Chief Clerk, Forecast Division.*

36° below zero in Minnesota. This low area occupied western Texas on the morning of the 25th, and moved thence northeastward with increasing strength to the Canadian Maritime Provinces by the 27th, attended by heavy snow in the Ohio Valley and southern Lake region, and by gales on the lower Lakes and along the middle and north Atlantic coast. On the morning of the 26th the following special warning was sent to points in New York and New England:

Heavy snow indicated for interior of New York and New England during next twenty-four hours, with high southerly shifting in New York to much colder northwest winds to-night.

The usual storm warnings were also hoisted well in advance of the gales that attended the storm. This depression apparently passed north of the British Isles during the 30th and 31st. The cold wave that followed this disturbance moved from the eastern slope of the Rocky Mountains over the Southern States and the Atlantic seaboard from the 25th to the 27th.

In connection with special frost warnings for southern California the San Francisco Call, of January 20, 1904, published the following dispatch dated Los Angeles, Cal., January 19:

Reports to-night from correspondents stationed throughout the orange districts of southern California are to the effect that the frost this morning did little damage to the citrus crop, which is now practically ready for market. Having received special warning from the Weather Bureau, hundreds of ranchers resorted to smudging this morning and thereby removed all danger to their crops.

From the 28th to the 30th a depression advanced from the Gulf of Mexico northeastward off the Atlantic coast, attended by heavy snow from the interior of the east Gulf and South Atlantic States to New England.

During the third decade of the month the upper Ohio River reached flood stages, and dangerous ice gorges formed in the mountain streams of Pennsylvania. Accurate warnings were issued in connection with the Ohio River flood, and all interests were fully advised regarding danger from ice and flood in Pennsylvania. The Doylestown (Pa.) Republican, of January 25, remarks editorially regarding these advices as follows:

The value of the service rendered by the Weather Bureau has been demonstrated in the last few days, when great floods threatened destruction to a vast amount of property. From the Bureau were issued warnings to the inhabitants of all the towns likely to suffer from the flood. While it was impossible to prevent damage to buildings, there was opportunity to remove merchandise and household goods to places of safety hours before the flood reached many towns. Through the Weather Bureau, the telegraph, and the press, not only the communities threatened by the flood, but business men in all sections of the State were informed not only as to present conditions, but what was likely to occur in the immediate future, all of which was of great service to the public.

BOSTON FORECAST DISTRICT.

The month was remarkable for heavy snowstorms, gales of great violence and duration, and cold waves of almost unprecedented severity. The most severe storms were those of the 2–3d, 8–9th, and 26–27th. It is generally considered that the storm of the 2–3d was the heaviest since the disastrous hurricane of November 26–27, 1898. Winds of hurricane force, with snow, prevailed along the southern coast on the night of the 2d and the morning of the 3d. During the storm a two-masted schooner was wrecked on Point Allerton, Boston Harbor; captain and crew were saved by the United States Life-Saving Service. On the 26th, two fishing vessels, small schooners, were wrecked near Gloucester; two others went ashore there, with more or less damage, and another went ashore at South Point, near Boston. Few vessels left their berths during threatening weather, and especially when storm warnings were displayed, which accounts for the small list of casualties. The Boston Globe of January 9, in commenting on the storm of the preceding day, said that—

Storm warnings were hoisted Thursday night and shipping throughout the New England coast was warned again yesterday, and the functions of the Bureau in this regard have once more proved of incalculable value. To its offices the shipping interests are once more indebted, as they have been innumerably in the past.

The heavy snowstorms of the month greatly retarded railroad and street car traffic and caused great additional expenses to transportation companies and to the cities. During the cold and severe storms many people were overcome and frost bitten, the hospitals were filled to overflowing, and several deaths resulted from the severe weather.

Seventeen storm warnings were issued during January, about all of which were fully justified. No storms or dangerous winds occurred without warnings.—*J. W. Smith, District Forecaster.*

CHICAGO FORECAST DISTRICT.

A series of cold waves passed across the district during the month. The first appeared in the British Northwest Provinces on December 31, 1903, and warnings were issued on that day for the western portion of the Chicago forecast district, and extended to the eastern portion by the morning of January 2. Another cold wave, although not as extensive or severe, moved eastward during the 16th, and was rapidly followed by an area of low barometer which affected its intensity. Warnings were sent in advance to the States threatened. No other general warnings were issued, but on the 23d and the 31st warnings were issued for the extreme eastern portion of the district. There was no decided thaw except on the 20th, 21st, and 22d, which caused damaging floods in the eastern and southern portions of this forecast district. Railroads in the flooded area were advised on the 21st instant that a cold wave was approaching, which would quickly put an end to the flood conditions. No general storms occurred during the month, except the one which passed up the Ohio Valley during the 2d. The snowfall, however, was intermittent during the entire month, resulting in considerable total fall. At the close of the month

the entire district was covered by snow, excepting Kansas and the southwest portions of Missouri and Nebraska.

Winter navigation was maintained as usual on Lake Michigan, and frequent storms affected vessel interests. Advices were sent to the open ports in advance of the storms, and no casualties have been reported. Shipping, however, has suffered much from the immense amount of ice in the lake, and frequently boats have been held fast for several days at a time.—*H. J. Cox, Professor and District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The most important features of the weather during the month were the decided falls in temperature which occurred on the 2d, 3d, 11th, 21st and 22d, 26th, and 29th, for all of which cold-wave warnings were issued. Frost and temperature warnings were issued on several dates for the benefit of the sugar and trucking interests, and they proved satisfactory to growers. High winds occurred at some points along the Gulf coast on the 2d, 3d, 20th, 21st, 22d, and 26th, for all of which timely warnings were ordered.—*I. M. Cline, District Forecaster.*

DENVER FORECAST DISTRICT.

Severe cold spells were notably absent, and but few special warnings were issued or needed. Such sharp temperature falls as occurred were local in character, and were quickly followed by mild weather. There was no interruption to railroad traffic in the mountains, and on the whole the weather conditions were favorable to live stock interests on the plains.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

December was unusually dry and January was also a month of drought. In the southern portion of the State, with the exception of rain on the 18th and 19th, the month was without precipitation. This condition in the very heart of the rainy season is unusual. In the northern portion of the State the rainfall has likewise been very light. The month began with moderate rains in the central and northern portions of the State, but these were quickly followed by cold, dry weather and heavy, low fogs.

A disturbance which appeared on the morning of January 15 moved eastward, but another disturbance on the morning of January 17 moved southward and caused general rain in California, with high southerly winds. Southeast storm warnings were displayed from San Francisco northward, and advisory messages were sent to southern ports. Both forecasts and warnings were verified. Frost warnings were issued on January 19, 20, and 21. Heavy frosts were reported at nearly all points on the 20th, 21st, and 22d.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND FORECAST DISTRICT.

From the 3d to the 17th storms frequently occurred on the north Pacific coast. Those of the 8th, 13th, and 16th were the most severe. During the storm of the 8th the steamer *Clallam*, plying between Seattle, Wash., and Victoria, B. C., was so buffeted by the waves that she sprung a leak and sank off Dungeness Spit early the next morning. Over fifty lives were lost by this disaster. An investigation as to its cause has been held by the steamboat inspectors, but their decision has not yet been made public. The fact remains, however, that storm warnings were flying in Seattle when the vessel left port, and about two hours later she entered the safe harbor at Port Townsend, where storm warnings were also displayed. The captain, however, regardless of the warnings, proceeded to sea and lost his boat and many precious lives. Storm warnings were displayed well in advance of every storm, and no other casualties occurred during the month, except a few of minor character.

On the evening of the 19th the conditions indicated much colder weather during the next twenty-four hours in the western portions of the district, and cold-wave warnings were issued to all stations. The drop in temperature, while marked and general, did not reach the zero point, except in eastern Oregon.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The Mississippi River continued solidly frozen from its source to below the mouth of the Des Moines River. It was also frozen at Hannibal from the 3d to the 21st, inclusive, but moved out on the 22d, under the influence of the heavy rains and higher temperatures of the 20th and 21st. The ice went out on a water stage of 9.5 feet, which increased to 11 feet by the 24th. On this date a gorge formed about four miles below Hannibal, backing up the water to such an extent that it reached a stage of 12.2 feet on the Hannibal gage on the 26th, exceeding all previous January records by 1.2 feet. Warnings of the expected rise were issued on the previous day. After the 26th the water slowly receded. The mean stage of the water for the month, 7.2 feet, was a very unusual condition. In fact, the lowest stage for the month, 4.2 feet, has been exceeded but twice during the past twelve years by the highest stage of any other January. The heavy rains and high temperatures of the 20th and 21st also started the ice in the lower Des Moines River, but it was checked at its mouth by the solid Mississippi ice. This caused the usual back water, and the result was a rapid flooding, on the 22d, of the low lands on both sides of the Des Moines River.

There was also considerable increase in the thickness of the ice in January. At St. Paul it increased from 18 to 26 inches; at Dubuque, from 10 to 24 inches; and at Davenport, from 9 to 20.5 inches. The Missouri River ice increased in thickness from 14.5 to 29.5 inches at Bismarck; from 12 to 19 inches at Sioux City; and from 6 to 13 inches at Omaha. Below Omaha the usual large quantities of floating ice were observed. A little ice was observed as far south as Memphis on the 8th, but there was none of consequence until the 30th, when the heavy ice of both the Ohio and Mississippi rivers passed down, interfering with, but not totally interrupting, navigation. In the Ohio River the conditions were such as to require constant vigilance, the culmination coming with the breaking up of the large gorges in the Allegheny and Monongahela rivers on the 22d, and the 30-foot flood at Pittsburg on the 26th, which reached the mouth of the river at the end of the month. The following report of the Pittsburg flood and its antecedent conditions was prepared by Mr. Frank Ridgway, official in charge, United States Weather Bureau office, Pittsburg, Pa.

The peculiar precipitation conditions which had prevailed throughout the Allegheny and Monongahela valleys during the most of the summer and all of the fall and early winter of 1903, contributed very largely in making this one of the most interesting and singular floods in the history of high water in this locality. From about July 1, 1903, to about the middle of January, 1904, very little precipitation had occurred in the entire Monongahela Valley, so that the water in that stream had reached a very low stage, which continued until the eve of the recent flood; on the other hand, the precipitation in the Allegheny Valley and tributaries during this same period was quite general, and at times excessive, monthly rises occurring in that stream. About the middle of November, after the cold weather had set in, frequent heavy snowfalls occurred throughout the Allegheny Valley, the snow averaging from 3 to 5 feet in depth until the arrival of the moderating weather which resulted in the flood. During this same period, however, the snowfall in the Monongahela Valley was comparatively light. These general conditions necessarily determined the fact that a sudden thaw, with the absence of rain, would result in an extensive freshet out of the Allegheny River, but with comparatively little water from the other river. The unusually long period of severely cold weather resulted in the formation of extremely heavy ice, which reached a thickness of from 18 inches to 2 feet on both rivers throughout their entire length, and also on all their tributaries. In addition to the frozen condition of the stream, as above stated, there had also formed three formidable ice gorges in the lower 50 miles of the Allegheny River, due to a slight moderation on December 23, 24,